Massive and Recurrent Hernias

Use of Dermal Grafts in Carrying Out Repair

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• **Graft of dermis is clinically and experimentally superior to graft of whole skin for use as reinforcement at the site of repair of hernia, for gross cysts do not form and it fuses better with the surrounding tissues than does whole skin. Placing either dermis or skin under tension helps prevent cyst formation and aids fusion with surrounding tissues. Dermal grafts are less liable to infection than are whole skin grafts, either at the time of operation or later.**

A split-split flap dermatome technique is presented as a preferred technique for obtaining a dermal graft from the thigh in cases of ventral hernia in which the abdominal skin is stretched, attenuated and inelastic because of the massive size of the hernia. This technique was used in 27 cases of massive hernia. There was infection in one case of the 27 and subsequent healing was satisfactory. One patient died of spontaneous rupture of an intracranial carotid aneurysm. Hernia did not recur in any patient.

A split-split free graft dermatome technique is presented for use in cases in which an elliptical segment of normal skin can be removed adjacent to an inguinal or thoracic incision for repair of a hernia or other use. This technique was used in seven cases of inguinal hernia and in one of diaphragmatic hernia with satisfactory results.

FREQUENTLY in massive and recurrent hernias the tissues are so weakened and attenuated that some reinforcing material must be added for adequate repair. Various foreign materials such as bovine fascia, metallic plates and filigrees have been used, but an autogenous graft offers the advantages of continuing as an integral viable portion of the host. Dermis, whole skin and fascia have each been used for these autogenous grafts with varying success. Clinical and experimental studies have reported several advantages of grafts with dermis over grafts of other types, but the more widespread use of dermis has been delayed by technical difficulties in securing the dermis. The present report concerns two new techniques to facilitate obtaining dermal grafts, and additional experimental and clinical evaluation of the use of those techniques.

Dermis was first introduced as a reinforcement for hernias in 1913 by Loewe,[1] and since then it has been used by a number of surgeons with generally favorable results. However, the techniques of obtaining the dermis were inexact and time-consuming and this led Mair[2, 3] to introduce the use of whole skin in 1945. In the use of whole skin, Mair relied on the clinical observations of Rehn and Uihlein that placement of a dermal graft under tension exerted an influence in preventing the development of cysts. Placement of the grafts under tension enabled Mair and others to utilize whole skin with a minimum of difficulty but clinical evidence of the tissue reaction to whole skin was noted by Strahan[6] who in a series of 413 cases of whole skin grafts used in herniorrhaphy kept the patients on strict bed rest for three weeks because of "the considerable reaction noted in most cases up to well over two weeks." Preliminary removal of the superficial epidermis from the dermis obviates the slough of this layer, and its attendant reaction. In a previously reported controlled experimental study[5] of a series of 25 dogs on the comparative merits of whole skin and dermal grafts in the repair of hernias, the appearance of gross cysts in implanted whole skin was reduced from 80 per cent when implanted without tension to 45 per cent when implanted with tension. The implantation of dermal grafts in the same animals produced no gross cysts, but in 40 per cent of dermal grafts without tension, minute cysts were observed on microscopic study of the grafts. Thus the importance of tension is clearly shown, as is the superiority of dermis over whole skin. Another important finding of the study was the frequent occurrence of nonunion of the whole skin with adjacent tissue due to the sequestration of the superficial epithelium, as contrasted to the firm fusion which rapidly occurred between dermal grafts and surrounding tissues.

During the previous study it was noted that with nonunion there was also necrosis of the tissues in a proportionate degree. This was borne out in another study in which cultures were taken of implanted dermal and whole skin grafts. A series of ten large nonpregnant mongrel dogs was used and a graft of different type was placed in each of the four abdominal quadrants of the animals. Dermal grafts, one with and one without tension, were placed in two of the quadrants and whole skin grafts

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also with and without tension in the other two quadrants. Cultures were then taken under sterile conditions after varying intervals of from one to five months. In the first five dogs an incision was simply made across the center of each graft and sterile swabs were drawn across each site. Both aerobic and anaerobic cultures were made. In each instance, if the graft had completely fused, the cultures were sterile, but with the presence of gross necrosis or cyst formation there was invariably a mixed bacterial growth on cultures. All the dermal grafts implanted with tension were sterile on culture. Six of the ten dermal grafts without tension were sterile. Only two of the ten whole skin grafts under tension and none of the whole skin grafts sutured without tension were sterile. In the last five dogs, small pieces of each of the grafts were removed for biopsy under sterile conditions and were weighed in autoclaved vials. The specimens were then crushed and ground with a sterile glass rod in a beef broth culture with washed and autoclaved sand in the bottom to aid in the grinding. Transfers were then made to culture plates. Although the whole skin implanted without tension appeared grossly to have the greatest infection, no quantitative statistical confirmation of this was accomplished by this means. However, the dermal graft implanted under tension was the only one of the four grafts in which there was no infection. Upon examination of the abdominal wall of the animals four months after implantation of the grafts, intimate fusion of the dermal grafts implanted under tension was noted, but the dermal grafts implanted without tension were less firmly fused. The whole skin grafts, both with and without tension, had incomplete fusion and cultures of material from both types had bacterial growth.

To test the initial bacterial status of dermis and surgically prepared whole skin, five specimens of fresh unimplanted dermis were ground with aseptic precautions and four of these were sterile to culture. There was mixed bacterial growth on the fifth. With whole skin which was prepared by a three-minute application of tincture of green soap, followed by alcohol, ether, tincture of zephiran and finally a second application of ether to remove all the antiseptic materials, all five specimens gave a positive mixed culture. From the foregoing it was concluded that dermis has a high percentage of initial sterility and appears to maintain this sterility especially when implanted with tension which aids early fusion to the surrounding tissues, and that whole skin was unsterile in spite of thorough surgical preparation. When implanted with tension, some of the whole skin grafts fused and apparently all bacteria were assimilated. However, the occurrence of necrosis of the epidermis and formation of cysts, especially in those implanted without tension, predisposed to a high incidence and frequent recurrence of bacterial growth. When biopsy of five human dermal grafts implanted under tension was carried out at various intervals of from one day to 34 months after the graft was done, no cysts were noted in any of the cases and even 34 months later the dermal graft was present as a viable part of the surrounding tissues with a good supply of blood. Studies of tension of fresh human dermis as well as that obtained on the eleventh postoperative day revealed that the dermis maintains a high degree of multidirectional strength, whereas human fascia is only strong in one plane and is inferior to dermis even in this plane. Tensionmetric studies revealed that 90 per cent of the strength of skin lies in the dermis. Hence, removal of the superficial epidermis does not much impair the strength of the tissue. (In nonmedical fields the dermis—leather—finds a greater application than either whole skin or fascia because of these same inherent properties.)

The previously cited advantages of dermis are believed by some investigators to be at least partially offset by the greater ease with which whole skin is obtained. However, dermal grafts can be obtained with a minimum of difficulty. The original technique of Loewe was to remove the full thickness skin with a scalpel, and then to scrape off the superficial epithelium with a sharp instrument much as a housewife cleans a carrot. This technique was not entirely satisfactory, as it gave a dermal graft which had very irregular upper and lower surfaces. An improvement was reported by Rehn[4] in 1914: He removed a Thiersch graft prior to removing the dermal graft from the underlying site with a scalpel. In 1939 Uihlein[8] reported Rehn's further modification in which the dermis was cut from a portion of the excised redundant skin. This technique eliminates the closure of a secondary donor site but is not often useful in a ventral hernia, for the skin is frequently thinned, atrophic, and inelastic over the hernia site. In 1943 Swenson and Harkins[7] reported the use of a dermatome to remove the epidermis following which the dermis was excised with a knife, and subsequently Harkins used Zintel's[9] method of resplitting a free skin graft to remove the superficial epithelium.

The first of the two techniques herein reported leaves an attached superficial epithelial skin flap which facilitates resuturing it to the donor site as compared with the detached graft technique. The second technique can be used if the skin appears normal in the area of incision. In this instance a free graft splitting technique is used. With each of these two techniques a uniform graft is obtained, with both surfaces smooth and regular.

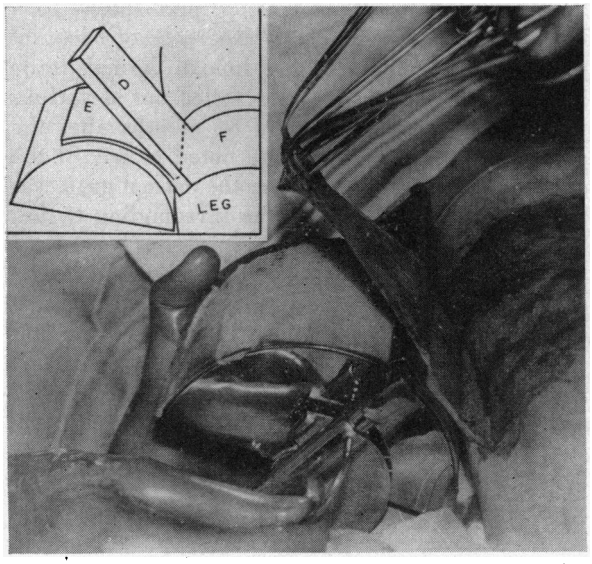

Figure 1.—Split-split flap dermatome technique. Dermis (D) being held up after separation from the subcutaneous fat (F) by the first cut, and from the epidermis (E) by the second cut.

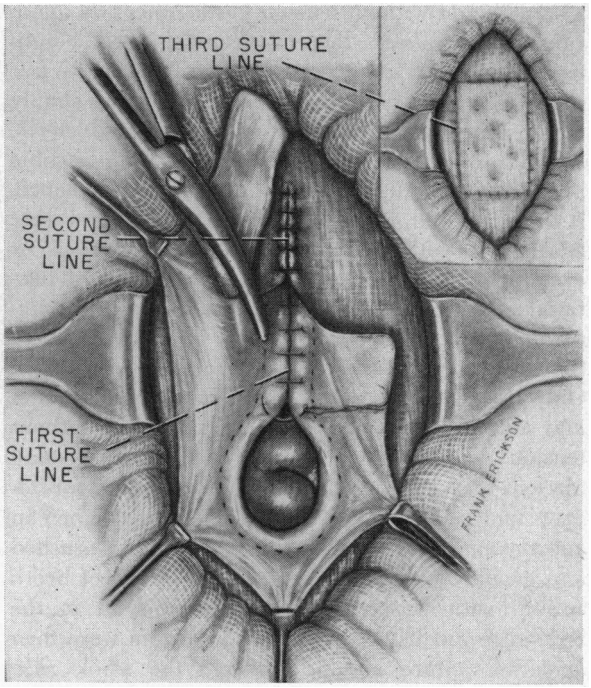

Figure 2.—Technique of repair of massive abdominal hernia with first suture line being closure of hernial ring from inside the sac. Second suture line is the approximated peritoneal edges of the sac. Third suture line is formed by the dermal graft with sutures over the surface as shown in the inset.

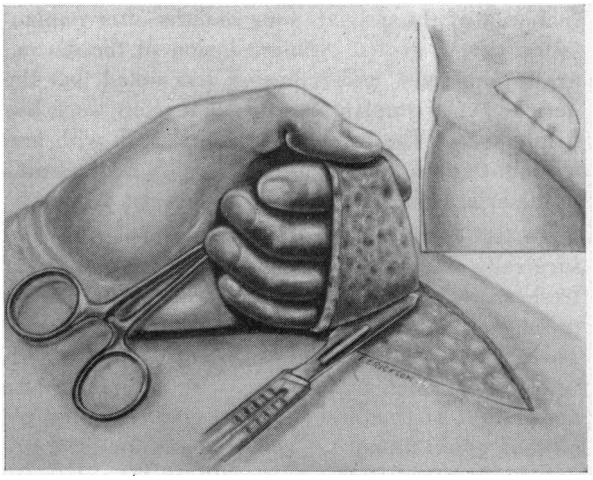

Figure 3.—Elliptical segment of skin adjacent to old herniorrhaphy incision is excised to obtain a source of dermis for repair of recurrent hernia (inset). Deep layer of skin is separated from subcutaneous fat by sharp dissection.

SPLIT-SPLIT FLAP DERMAL GRAFT TECHNIQUE

No elaborate preoperative preparation of the donor site on the thigh is done. The area is shaved, and immediately before operation the skin is washed with soap and water for three minutes. Then alcohol, ether and tincture of zephiran are applied. Ether is then used a second time to remove the zephiran. The drum is cleansed with ether and the blade is set at 34 thousandths of an inch from the drum for an adult and 22 thousandths of an inch for a child. Glue is applied to both the dermatome and the donor site and permitted to dry for five minutes. An important point in this regard is to apply glue on the leading edge of the drum so that when the drum is placed in contact with the donor site, skin will overlap the edge. This position is held for one minute before making the initial incision which separates the deep surface of the dermis from the subcutaneous fat. The blade is then drawn back to within one-fourth inch of the starting point, with care taken not to draw the blade back over the starting edge of the flap. The knife is then lowered to 10 thousandths of an inch from the drum for children and to 12 thousandths for adults, and a second cut is made (split-split) separating the upper portion of the dermis from the superficial epidermis as shown in the inset of Figure 1. The base of the dermal flap is then cut off (as depicted by the dotted line in the same figure). A warm moist saline pack is placed over the subcutaneous fat to control bleeding. The superficial epithelium which is still attached to the thigh is then replaced in position and the remaining three sides of the flap then resutured with interrupted 0000 silk, and ointment gauze, sterile fluffs and an elastoplast pressure dressing are applied.

The dermal graft obtained by this technique is uniform in thickness and smooth on both surfaces. It is used as a reinforcement of a previously executed herniorrhaphy in which the simple repair is

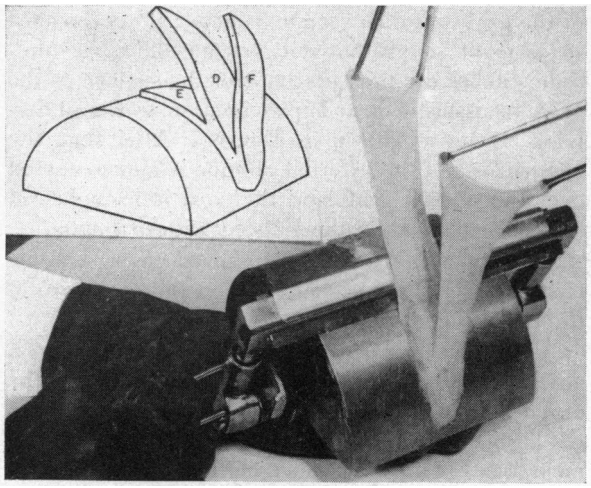

Figure 4.—Split-split free dermal graft technique. The skin ellipse has been separated into subcutaneous fat (F), dermis (D) and epidermis (E) by the two cuts.

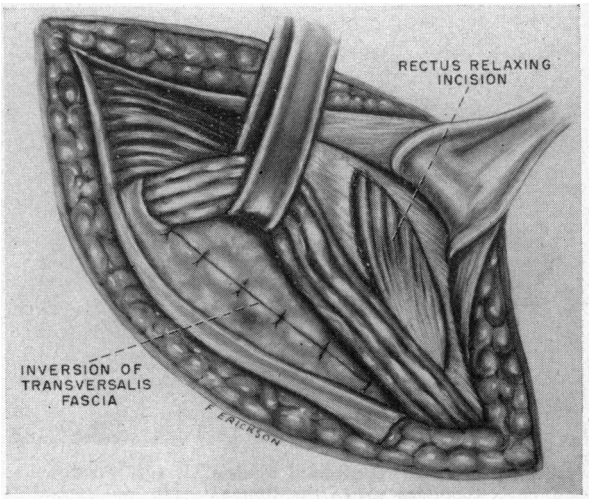

Figure 5.—A relaxing incision is made in the rectus fascia near the junction of the internal oblique to the external oblique and the transversalis is inverted and sutured up to the internal inguinal ring.

not thought to be adequate by itself. In massive ventral hernias an elliptical incision is made, excising the old scar and excess skin. The lateral skin flaps are freed, exposing the fascia, which is dissected clear for at least one inch surrounding the hernial ring. The sac is opened and the contents are freed and reduced. The abdominal wall layers surrounding the hernial ring are frequently fused into a thin layer and any attempt to separate them for a closure in layers is unsatisfactory and further weakens the area. Hence, the closure is done in one layer from inside the sac with interrupted silk. This first suture line (Figure 2) includes the hernial ring and the inner surface of peritoneum. The excess sac is removed and approximation of the peritoneal edges constitutes the second suture line. The dermal graft is then placed over the closure and at least one inch of surrounding fascia and sutured under tension, using interrupted nonabsorbable sutures. Additional interrupted sutures are placed through the surface of the graft to aid in approximation to underlying tissues. The graft then (Figure 2, inset) represents the third suture line. The subcutaneous tissues are sutured down to the graft to obliterate all dead space. Sterile compressions dressings are applied to the abdomen to complete the operation.

This technique was used in 27 cases of massive hernia and the patients have been observed for varying intervals up to five years. In all these cases the ring was at least 4 cm. in circumference and the capacity of the sac was 500 cc. or more. Five were ventral (incisional) hernias, ten inguinal hernias, one congenital ventral hernia (omphalocele) and one diaphragmatic hernia. The one infection in the series occurred after a small subcutaneous seroma was mistakenly treated by partially reopening the incision instead of aspirating the fluid. Subsequent healing was satisfactory. One patient died of spontaneous rupture of an aneurysm of the internal carotid artery on the eleventh day after operation. There were no recurrences of hernia in the series.

SPLIT-SPLIT FREE DERMAL GRAFT TECHNIQUE

For large recurrent direct inguinal hernias, an elliptical skin segment of normal skin can usually be excised adjacent to the old incision, and a dermal graft then is obtained from this segment by the split-split free dermal graft technique. This technique can also be used to obtain a dermal graft at other sites where the skin is grossly normal. In the inguinal area the skin ellipse is cut from the subcutaneous fat as shown in Figure 3. Glue is then applied to the superficial surface of the skin ellipse and to the dermatome. The skin is applied to the dermatome and the initial incision is made at a depth of 40 one-thousandths of an inch. The blade is then drawn back and lowered to 12 one-thousandths of an inch from the drum prior to the second cut. The skin ellipse has therefore been split into subcutaneous fat, dermis and epidermis as shown in Figure 4.

The dermal graft is used as a reinforcement of a Cooper ligament hernia repair. A relaxing incision is made in the rectus fascia near the junction of the internal oblique to the external oblique and the transversalis is inverted and sutured as shown in Figure 5. The "conjoined tendon" is then sutured down to Cooper's ligament up to the femoral vein and lateral to this to the inguinal ligament, as shown in Figure 6. The next step is to suture the dermal graft to the pubic tubercle, the rectus and internal

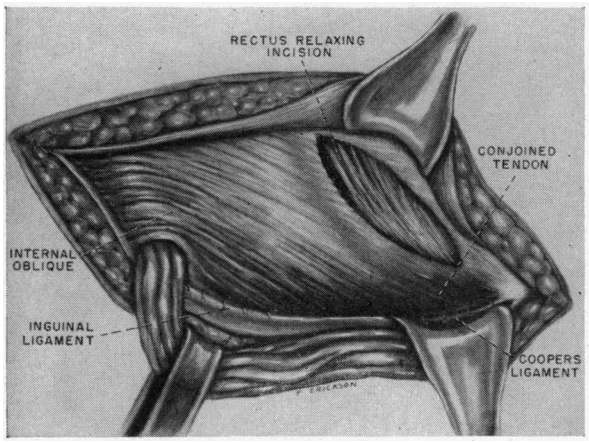

Figure 6.—The "conjoined tendon" is sutured down to Cooper's ligament up to the femoral vein and lateral to this to the inguinal ligament.

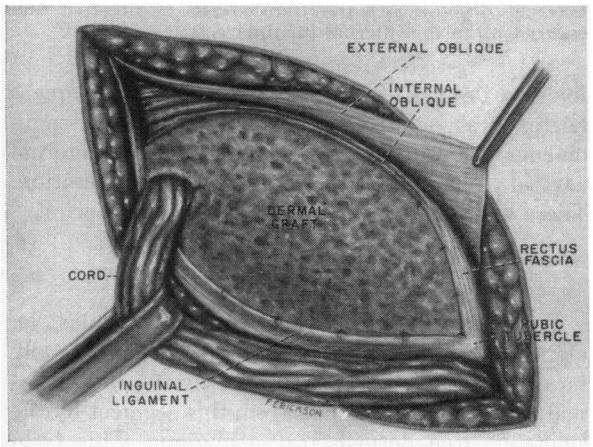

Figure 7.—Dermal graft shown sutured under tension to the pubic tubercle medially, the rectus and internal oblique fascia superiorly, and the inguinal ligament inferiorly. Multiple stitches over the surface assure approximation to underlying tissues. The cord emerges subcutaneously, through an incision at the upper end of the graft. The aponeurosis of the external oblique is then approximated over the dermal graft, with the cord remaining subcutaneous.

oblique fascia and the inguinal ligament, with the cord lying superficial to the graft. An incision is made near the upper end of the graft for emergence of the cord from the external ring, and the two ends of the graft are then reapproximated about the cord so as to fit snugly but not strangle the cord. Multiple stitches are then placed over the surface of the graft to assure a firm approximation to the underlying tissues as shown in Figure 7. After that, the aponeurosis of the external oblique is approximated over the dermal graft and the cord is brought out subcutaneously as in the Halsted herniorrhaphy.

This technique was used in seven cases. The period of observation after operation was from two to three years and the results were satisfactory.

A similar dermal graft technique was used in a paraesophageal diaphragmatic hernia in which the diaphragm was thinned and weakened adjacent to the hernia site. The dermal graft used for reinforcement was obtained by this technique from an elliptical segment of skin adjacent to the thoracotomy incision. The results were satisfactory when the patient was observed four months after operation. This same technique has been used to prepare dermal grafts for other purposes, including animal experimental work; it is useful in preparing dermis for any of the variety of uses for which it is suited.

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